Development (1948) Department

Ms SERIES.

G.O. No. 460

Dated 9-9-48

[Despatch Abstract.]

Indian Council of Agricultural Research - Scheme of blast and foot-rot diseases of rice - Extension proposal

GOVERNMENT OF MADRAS.
Development Department.

Letter/Miscellaneous No. 4608.

From

Sri. W.R.S. Sattianathan, I.C.S.,
Secretary to Government.

To

The Secretary to the Indian Council of Agricultural Research,
New Delhi.

Dated, Fort St. George, the 9th September 1948.

Sir,

Sub:- Agriculture - Indian Council of Agricultural Research - Scheme of research on blast and foot rot diseases of rices - Extension proposals - Forwarded.

Ref:- Your letter No. F.55(6)/45/A. dated 7.12.1946.

I am directed to forward herewith proposals for the extension of the scheme of research for the investigation of Blast and Foot rot diseases of rice in Madras Province for a period of three years from 1.4.1949. The extension scheme is estimated to cost Rs. 43,821/- recurring. The shares of the Indian Council of Agrl. Research and the Provincial Government are Rs. 20,173 and Rs. 23,648 respectively.

2. I am to request that the sanction of the Indian Council of Agricultural Research for the continuance of the scheme may kindly be obtained and communicated to this Government.

Yours faithfully,

(Sd) W.R.S. Sattianathan,
Secretary to Government.

the Director of Agriculture. He is requested to submit the usual printed copies of the scheme for forwarding to Indian Council at an early date.

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INDIAN COUNCIL OF AGRICULTURAL RESEARCH.

Scheme of Research for the investigation of Blast and Foot-rot Diseases of Rice in the Madras Presidency.

Proposals for a further extension of the scheme for three year from 1949.

INTRODUCTION.

A scheme for the investigation of two major diseases of rice in the Madras Presidency was started in July 1943. The scheme was extended for a period of three years from 1946, and the extension is due to expire by 31st March 1949. The total amount sanctioned for th original scheme was Rs. 27,100 of which the share of the Indian Council of Agricultural Research was Rs. 11,790/- and the share of the Government of Madras was Rs. 15,310/.. The sanctioned grant for the

first extension scheme is Rs. 41,551 of which the share of the Indian Council of Agricultural Research is Rs. 19,038 and the share of the Government of Madras Rs. 22513. (G.O. No. 3870, Development, dated 31st July 1947).

OBJECT OF THE SCHEME.

The object of the scheme is to investigate (1) the blast disease of rice caused by the fungus Piricularia oryzoe and (2) the foot rot disease of rice caused by the fungus Fusarium moniliforme var. majus with a view to devising suitable methods of control such as the utilization of resistant varieties, and the use of fungicidal treatments in order that the losses caused by these diseases may be reduced or averted.

WORK DONE SO FAR.

The work done so far in accordance with the approved technica programme of the original and extension scheme is summarized below:-

Item 1:- Blast (Piricularia oryzoe) varietal resistance trials:

Paddy varieties exhibit considerable amount of variation with regard to their susceptibility to blast incidence. With a view to assessing their relative susceptibility under conditions favourable for the spread of infection, field experiments were carried out and the relative susceptibility of a large number of varieties were evaluated. The results of the experiments were statistically analysed and based on the record of their performance for two or three years, a few resistant types were selected, and these were further subjected to artificial inoculation under controlled conditions, and such of those, which stood this test, were grown in replicated plots along with control varieties, in a few representative centres in order to ascertain their suitability to different tracts. The last item of work was carried out with the kind co-operation of Paddy Specialist, Madras, and the District Officers of the respective tracts in which the trials were carried out. During the period of five years 1943-48 the scheme has been working, 296 varieties were tested in the field and of these 253 varieties were from the Madras Province and 33 from other Provinces in India (pre-partition) and 10 from Burma. The varieties tested comprised the following three groups:-

	Number.
Long duration, 160 days and above.	163.
Medium duration, 120 to 160 days.	114.
Short duration, 95 to 120 days.	19.

It is gratifying to note that a number of cultures showed high degree of resistance and the following is a list of such varieties

	Number. (1)	Name of variety. (2)	Category of - duration. (3)	Mean percentage of incidence in 5 years' trials. — (4)	Grain yield in ounces. (5)
1.	1	Co. 4.	Long.	0.0	10.4.
	2.	3/840	"	1.1	13.3.
	3.	3185	"	1.1	11.7.
	4.	2744	"	1.4.	10.4.
	5.	2380	"	1.5.	11.8.
	6.	2552	"	1.5.	12.1.
	7.	2554	"	1.5	11.7.
	8.	3273	"	1.5	12.0.
	9.	2555	"	1.7.	11.6.
	10.	8036	"	1.7	13.1.

(1)	(2)	(3)	(4)	(5)
11.	3839	Long	2.0	12.9.
12.	3635	"	2.2	12.6.
13.	2364	"	2.6	10.8.
14.	2366	"	2.7	12.3
15.	2486	"	2.8	13.3
16.	Ptb. 16	Medium Long	2.8	8.8.
17.	3381	"	3.0	12.9
18.	3342	Long.	3.1	12.5.
19.	2550	"	3.2	13.3
20.	2713	"	3.2	12.2
21.	2202	"	3.4	10.5.
22.	8037	"	3.4	11.7
23.	2488	"	3.8	13.7.
24.	3820	"	3.9	10.6
25.	2501	"	4.0	12.4
26.	3383	"	4.0	10.4.
27.	3458	"	4.2	12.1.
28	3892	"	4.5	12.2
29.	4067	"	5.1	11.7
30.	3912	"	5.4	13.0
31.	8348	"	5.4	12.8
32.	4070	"	5.6	12.2
33.	2507	"	5.8	12.6.
34.	3941	"	6.0	11.4
35	Co. 55.	"	8.8.	11.9.
36.	Control Adt.10.	"	52.2	5.4

In this connexion mention has to be made that in the year 1948 owing to extreme drought during greater part of the season, and the consequent unfavourable condition for the spread of infection in the field, the incidence of disease was negligible, and even the susceptible check varieties more or less completely escaped infection. In the previous four years, infection was sufficient magnitude to give statistically significant results and the varieties listed above have consistently shown high degree of resistance when the control varieties grown along with them showed high incidence.

Among the varieties tried in the field, fifteen of the more resistant cultures, viz., Co. 4, 2364, 2380, 2486, 2552, 2555, 2744, 3185, 3273, 3381, 3635, 3839, 3840 and 8036 were subjected to artifical inoculation and except for an almost imperceptible necrotic lesion on the inoculated spot, there was no sign of infection noticed while in the control varieties (Adt. 10 and Co. 13) the inoculated plants showed severe infection. Besides these, 200 cultures kindly supplied by the Paddy Specialist from his collections of world varieties were subjected to artificial inoculation in the seedling stage in the field. As the conditions were unfavourable for infection, negligible incidence was noticed in all the cultures.

Among the resistant material, Co. 4 showed outstanding resistance but unfortunately its very long duration and the quality of its grain militate against its being distributed as a suitable variety in the tracts where the disease is prevalent. Two resistant culture 3840 and 3912 showed other desirable qualities also along with a fairly high yield record, and these have been selected for distribution to ryots by the Madras Agricultural Department as blast resistant types. Both the cultures are crosses of Co. 4 with Adt. 10

Item 2 :- Effect of graded doses of nitrogen:- Experiments were laid out to find out the effect of application of varying doses of nitrogen on the incidence of disease with (1) a susceptible, (2) a moderately susceptible and (3) a highly resistant cultures of rice and the experiments have given interesting results which are as follows:-

Both in the highly susceptible variety Adt. 10 and the moderately susceptible variety Co. 11 increasing levels of nitrogen

tends to increase the susceptibility though at the minimum dose of nitrogen applied, viz., 20 lb. of nitrogen and basal dressing of 5,000 lb. of green leaf per acre, the susceptibility of the variety was on a par with no manure and the yield was also proportionately affected. In the resistant variety Co. 4 a dosage up to 60 lb. nitrogen (the maximum dosage tried) has had no effect on the incidence of disease and increasing levels of nitrogen gave increasing yields

In the extension scheme a pot experiment to test the effect of NK. and P in varying levels was carried out. The results showed that the nitrogen starved pots did not show normal growth but no significant results were obtained with regard to incidence of disease. The experiments is being repeated both in the field and pots.

Item 3 - Comparative morphology of Piricularia species isolated from different hosts:- The behaviour of isolated of Piricularia from rice (Oryzoe Sativa), ragi (Elecusine Coracan), tenai (Setaria Italica), Digitaria Marginata and Panicum repens was studied in relation to various sources of nitrogen supply, hydrogen-ion concentration and temperature.

The isolates exhibited considerable similarity in their physiological behaviour except in regard to their temperature relationship, the isolate from tenai showing best growth at 20 o C while the others showed best growth at 30 o C. Among the sources of nitrogen tested, the supply of nitrogen as peptone resulted in best growth in all the isolates. The optimum hydrogen-ion concentration for all the isolates was found to be P. H. 8.

Item 4:- Alternate hosts of Piricularia oryzoe:- The finding, that the grass (Panicum repens) is an alternate host of Piricularia Oryzoe is important inasmuch as it explains how the fungus tides over the off-seasons in tracts where the disease occurs periodically. The grass is ubiquitous in distribution and is of common occurrence in all paddy fields growing in the bunds.

Pathogenicity trials with isolates of the fungus from Panicum repens on rice and from rice on Panicum repens gave positive results in both cases and field observations made during the five years furnish ample evidence that the initial inoculum for the spread of infection is mainly if not entirely from this grass.

Besides Panicum repens, Digitaria Marginata is another suscepti host of the fungus. But as, the distribution of the grass is restricted to the hills and cooler regions of the Province, its role as agent in the spread of disease in the plains does not appear to be significant.

Item 5 - Determination of factors responsible for disease resistance:-Previous work in Japan had given indication that resistance to Piricularia is related to the Silica content of epidermal cells. Work carried out at Coimbatore during the extension period of scheme has shown that the resistant types Co. 4 and 3840 showed larger number of silicated epidermal cells in unit area than the susceptible types, when 'Spodograms' of corresponding material from both types were examined. Study in respect of other histological characters, Ph. of cell sap, etc is in progress.

Item 6:- Study of methods of control of the disease in the nursery:- As per the technical programme approved by the Indian Council of Agricultural Research a field experiment was laid out in 1947-48 to study the relative efficacy of (1) bor-daux mixture, (2) perenox and (3) sulphur in controlling the disease in the nursery. As the weather conditions during the season was unfavourable for the development of the disease, the incidence of disease was negligible and the results were not siginificant.

Item 7 - Epiphytology of the disease:- Observations made on the incidence of the disease in different tracts of the Presidency durin

the five years of the scheme have shown that the conditions which favour the spread of infection of the disease in the field are more dependent on the amount of dew that is desposited on the plants and the length of time before the dew is off than on heavy rainfall and excessive humidity. The latter conditions are, however, important for the development of the disease in the host.

Cool nights followed by cloudy morning as obtain the districts of Tanjore, Nellore and Chittoor during the months of December and January have been noted to be extremely favourable for the spread of infection. It is surmised that the absence of the disease in an epiphytotic scale in the susceptible varieties grown in the Godavari delta in spite of fairly heavy rainfall that obtains there, is attributable to the fact that the harvest of the crop is over by the middle of December. In Nellore and Tanjore districts, where the disease periodically breaks out, the crop is standing in the field in the months of December, January and February, when conditions are extremely favourable for the spread of infection.

The study of condition favouring the breaking out of the disease as an epiphytotic has yet to be undertaken on a systematic scale and it is proposed to include this item in the extension programme.

II. FOOT-ROT - FUSARIUM MONILIFORME VAR. MAJUS.

The investigation of the disease was carried out as per the technical programme. Ninety-six varieties of rice were tested for their relative resistance and four of them proved to be resistant to the disease.

The fungicidal trials which are carried out for a period of five years showed that the disease could be completely controlled by treatment with certain organo-mercury compounds like Ceresan and Agrosan at the rate of 1 gram per pound of seed. Based on the results of these experiments, large-scale demonstrations were carried out in the Gobichettipalayam taluk of Coimbatore district where the disease was causing considerable amount of damage in earlier years. One thousand seven hundred and fifty acres (in 2 years) were sown to seed treated with the fungicides (Ceresan Tillantin R and Agrosan GN) and the disease was completely absent in the treated area. The Madras Agricultural Department have included in their programme of work connected with control of pests and diseases an organized compaign for the eradication of the disease by seed treatment in the districts of Coimbatore, West and East Godavari.

Under the instructions of the Council, a short note on the disease and its control was prepared and submitted for the benefit of other Provinces.

Conclusion:- The Advisory Board of the Council were pleased to remark when considering the report of the scheme for 1946-47 that the progress of work was very satisfactory and that the scheme hasgiven good results.

PROPOSALS FOR EXTENSION.

From the summary of results given above, it would be seen that the work programmed under the scheme is comprehensive and while the work done so far has given tangible results in regard to the selection of blast resistant varieties for long duration types of rice and the control of foot rot disease of rice by treatment of seed with organo-mercury compounds, considerable amount of work remains to be done in regard to other aspects which are important. They are as follows:-

1. BLAST DISEASE - PIRICULARIA ORYZOE.

(a) Varietal resistance in short duration types:-The

blast disease is a serious limiting factor in rice production in the districts of Vizagapatam, Chittoor, Chingleput, Tanjore and Nellore. Resistant material of long duration types are now available for Tanjore and Nellore. But, in the other three districts and also in large area in Coimbatore and Madura, the bulk of the crops is raised from short duration types. Unfortunately, all the short or medium types grown in the Presidency have been found to be extremely susceptible to the disease. It has been noted also that in these tracts the disease causes considerable damage both in the nursery and transplanted crop resulting in considerable loss year after year. In 1947 in the Chittoor district, there was total failure of the crop in many taluks on account of the diease. With a view to provide resistant types of short and medium duration varieties suitable to these tracts, the Paddy Specialist of Madras has effected a number of crosses of short duration types with Co. 4 as a resistant parent and a number of hybrids are now available from which resistant types have to be selected. This material has to be evaluated under standard conditions for disease resistance, and it is proposed to include this as a major item in the programme of work in the extension scheme for which sanction is now sought.

(b) Epiphytology of piricularia oryzae:- Very little is known regarding the conditions which favour the breaking out of the disease in an epiphytotic form. Theoretically, three conditions are pre-requisit for the outbreak of epiphytotics; (1) Abundance of inoculum, (2) susceptibility of host, (3) favourable weather conditions for the multiplication and spread of inoculum. As mentioned earlier, certain observations have been made in the field which throw some light on these aspects. But in order to obtain precise and accurate information, further work is necessary both observational and experimental. Laboratory studies to find out optimum conditions of germination of spores infection and development of the fungus in the host have to be undertaken and correlated with observations recorded in the field in selected areas where weather records can be maintained.

The detailed programme of this aspect will be drawn up in consultation with the Agricultural Meteorologist with regard to recording of observations on the weather.

(c) Physiological races of the fungus:- Certain paddy varieties which show high degree of resistance to Piricularia in some tracts prove to be susceptible to the disease in other tracts. While the possibility of the breaking down of their resistance due to environmental causes such as a high nitrogen content of the soil, there is reason to believe that infection in these cases is due to the existence of physiological races of the fungus. Investigation on this aspect has to be taken on hand and isolates from different tracts will be studied by pathogenicity tests on different varieties of rice under controlled conditions.

(d) Factors of disease resistance:- The study of this aspect has to be continued for a further period before definite conclusion could be drawn.

(e) Comparative morphology of the fungus from different hosts:-

The work will have to be continued for a further period before the study is completed.

(f) The incidence of disease in relation to application of manures:- The Advisory Board of the Council in its last meeting have suggested that further work on the relation of manures to disease such as the optimum dose of nitrogen, effect of NK. and P. alone and in combination with each other on the incidence of disease have to be undertaken. This will receive attention during the extension period.

II. FOOT-ROT OF PADDY (FUSARIUM MONILIFORME VAR. MAJUS).

The control method which have been found effective, cheap and easy of adoption have to be popularized in area where the disease is prevalent. This aspect will receive attention in the extension programme and arrangements will be made for large scale demonstration in the selected areas.

In regard to foot-rot disease of rice, certain aspects which have not received sufficient attention so far requires further investigation. They are (1) manner in which the seed grain gets infected, (2) conditions under which the disease assumes dangerous proportion and (3) physiological races.

In the extension scheme attention will be devoted to study these aspects.

TECHNICAL PROGRAMME.

The proposed Technical Programme of the extension scheme is as follows:-

I. Blast - Piricularia oryzoe.

1. Varietal resistance studies - continuation.
2. Study of epiphytology of the disease.
3. Study of physiological races of the fungus.
4. Study of factors of disease resistance.
5. Incidence of disease in relation to the application of manures.

II. Foot-rot - Fusarium moniliforme:-

1. Large scale demonstration of method of control.
2. Varietal resistance and fungicidal studies - continuatio
3. Study of mode of secondary infection.
4. Study of conditions favouring development of disease.
5. Study of physiological races of the fungus.

Duration of the extension scheme:- It is suggested that a further extension for a period of three years from 1st April 1949 be sanctioned.

Staff:- The existing staff of one Assistant Mycologist, two assistants, two fieldmen and one laboratory attender may be retained.

FINANCIAL STATEMENT.

Staff.	1949-50.	1950-51.	1951-52	Total for three years.
	Rs.	Rs.	Rs.	Rs.
Assistant Mycologist on Rs. 230-30/2-260-40/2-500-50/2-700 to start on Rs. 300.	3,600	3,720	4,080	11,400.
Dearness allowance at 17½ per cent of pay plus Rs. 6 upto Rs. 300 and 17½ per cent for above Rs. 300	702	704	714	2,120.
Two assistants on Rs. 100-5-140-10-220 to start on Rs. 115.	2,790	2,910	3,030	8,730.
Dearness allowance at 17½ per cent plus Rs. 8.	680	701	722	2,103
Two fieldmen on Rs. 45-2-55-1-60, one to start on Rs. 51 and another on Rs. 45.	1,158	1,188	1,236	3,582.

Staff.	1949-50.	1950-51.	1951-52	Total f three years.
	Rs.	Rs.	Rs.	Rs.
Dearness allowance at Rs. 22/- per month.	528	528	528	1,581.
House rent allowance for one fieldman at Rs. 6½ per month.	78	78	78	234.
One laboratory attender on Rs. 24-1-32-½-35, to start on Rs. 27.	327	339	351	1,017.
Dearness allowance at Rs. 19/- per month.	228	228	228	684.
House rent allowance at Rs. per month.	30	30	30	90.
One peon on Rs. 16-½-25, ⅋ to start on Rs. 17½.	212	218	224	654.
Dearness allowance at Rs. 18/- per month.	216	216	216	648.
Dearness allowance at Rs. 18/- per month.				
Travelling allowance.	1,000	1,000	1,000	3,000.
Other charges:-				
Apparatus and materials.	300	300	300Ø	900.
Cultivation expenses.	800	800	800	2,400.
Contingencies.	200	200	200	600.
Dearness allowance to menials.	200	200	200	600.
Total.	13,049	13,360	13,937	40,346.

Note:- House rent allowance provided in respect of one fieldman and one attender only. The rest of the subordinat staff are residing in the Agricultural College esta which is outside the municipal limits of Coimbatore.

Recurring expenditure.	Rs.	40,346.
Contribution of the Indian Council of Agricultural Research - 50 per cent of the recurring expenditure.	Rs.	20,173.
Contribution of the Madras Govt. - 50 per cent of the recurring expenditure.	Rs.	20,173.
Rent of land and laboratory to be borne entirely by the Madras Government as previously fixed.	Rs.	3,475.
Total contribution of the Madras Government.	Rs.	23,648.
Total cost of the scheme.	Rs.	43,821.

Agricultural College and Research Institute,
Lawley Road, Coimbatore,
14th August 1948.

(Sd) D. Marudarajan,
Government Mycologist.

/True copy/

R. Nagarajan 27.1.54
Office Assistant,
Madras Record Office.

27/1/54

k.y.s.